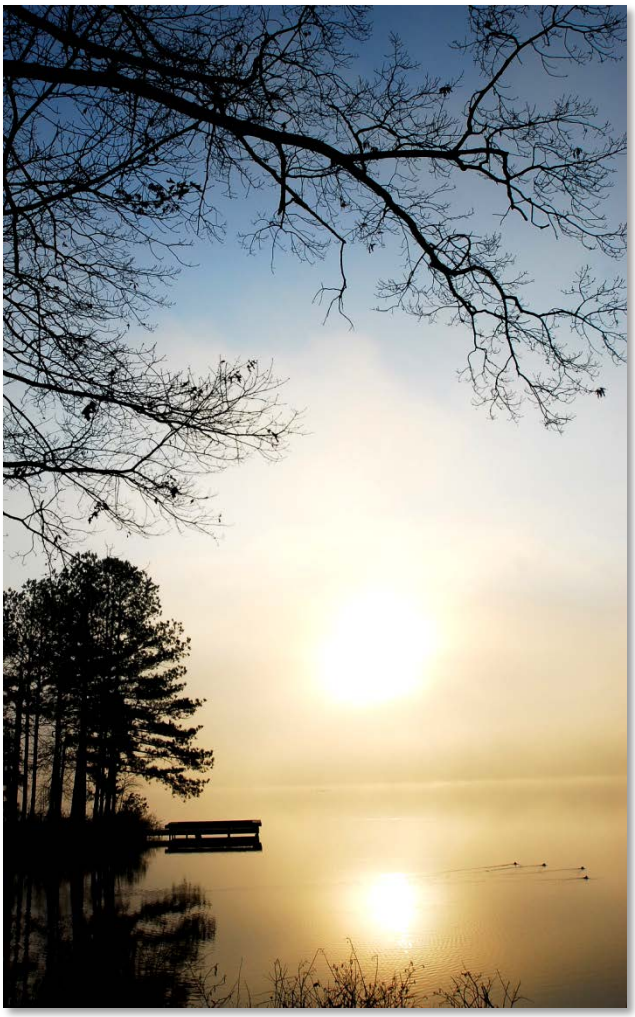
DRAFT CHAPTER 9: ENVIRONMENT

Overview

A wealth of land, air and water resources exists in Chesterfield County, contributing to a high quality of life. These resources are one of many factors that shape development in the county. Innovative designs should incorporate these resources into development to enhance the landscape and community while at the same time accommodating growth and development.



Certain land, air and water resources are protected by federal, state and county laws and regulations. These legal requirements are designed to protect natural resources for the health, safety and welfare of county residents. Understanding the benefits of these resources and the requirements governing them is important to successfully integrate environmental and developmental goals of the Plan. This chapter:

- Provides an overview of the county's land, air and water resources.
- Identifies factors and existing requirements that impact these resources.
- Identifies the relationship between these resources and development.
- Identifies impacts of human activities on these resources.
- Suggests guidance for consideration of these resources into development.

DESIRED OUTCOMES

- **Protection of important natural resources**
- **Recognition and role of federal, state and local requirements**
- **Environmental features incorporated into development for active and passive recreation**
- **Protection of life and property**
- **Promote farming and forestry as viable industries along with agri-tourism**
- **Recognition of the impacts from development on natural resources**
- **Support protection of green infrastructure for community mental and physical health**

Green Infrastructure Approach

The Committee on the Future published a report in 2005 titled "Green Infrastructure: Protecting Resources for Future Generations." This report suggested the county take a strategic and coordinated approach in protecting natural, cultural and historic resources to benefit the quality of life of citizens. Such an approach would tie together many topics addressed in this chapter as well as other chapters of the Comprehensive Plan such as the public drinking water supply, public facilities, land use and bikeways and trails. By planning for green infrastructure in the same manner as planning for gray infrastructure such as road and utilities, the county could take advantage of the ecosystem services provided by nature.

GREEN INFRASTRUCTURE – A strategically planned and managed network of wilderness, parks, greenways, conservation easements and working lands with conservation value that support native species, maintains natural ecological processes, sustains water and air resources and contributes to the health and quality of life for communities and people.

ECOSYSTEM SERVICES – Ecosystem goods and services produce the many life-sustaining benefits we receive from nature—clean air and water, fertile soil for crop production, pollination, and flood control. These ecosystem services are important to environmental and human health and well-being, yet they are limited and often taken for granted. – US EPA.

A green infrastructure approach starts with the comprehensive plan and is incorporated throughout the zoning and development process. This approach would also influence public investment in parks and other public facilities as well as develop private partnerships. Natural resources, such as forests, function better when intact and not fragmented, thus it is important that natural communities stay connected across various properties. This can be accomplished by clearly identifying natural resources early in the planning process and offering incentives that ensure the preservation and protection of these resources not only on individual projects, but also across property boundaries. Natural resources can be incorporated into residential and commercial developments as passive or active open space, but also be providing important functions such as improving air quality, flood control and providing wildlife habitat.

As the county continues to develop in previously undeveloped areas, natural features such as tree canopy should be encouraged to be retained or protected. Green spaces should be incorporated into all development projects, and wherever appropriate, be made key features of such development. Green spaces in urban, suburban and rural areas will differ from each other, but are important components of each setting.

Mission of Committee on the Future Green Infrastructure Report:
To enhance the quality of life in Chesterfield County by incorporating a green-infrastructure plan into the planning process as a critical public commitment to ensure social, economic and environmental benefits for present and future generations.

Land Resources

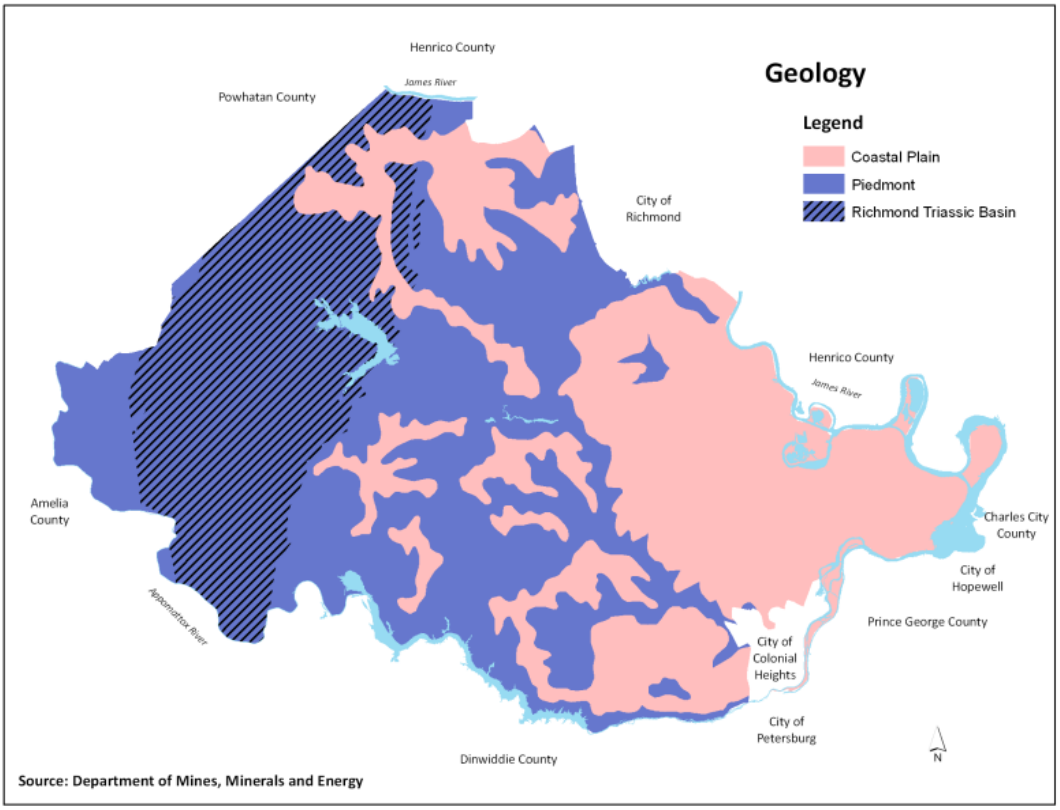
GEOLOGY, TOPOGRAPHY AND SOILS

The county's terrain rises from sea level on the eastern boundary to 390 feet above average sea level on the western boundary.

Landform regions are areas having similar terrain shaped by a common geological history. Chesterfield County is located in two landform regions, the Piedmont and Coastal Plain. Each of these regions has distinct characteristics in terms of geology, topography and soils. The fall line between the two landforms marks the limits of navigation on the James and Appomattox Rivers and is the approximate location of an ancient shoreline when the sea level was higher than it is today. Steep slopes in both landform regions are subject to severe erosion when disturbed.

The Piedmont landform occupies the largest area of the county, with rolling hills and well-drained soils. An area known as the Richmond Triassic Basin extends into the Piedmont landform and is characterized by soils with the potential to excessively shrink when dry and swell when wet. The Coastal Plain is mostly concentrated in the eastern portion of the county, and is generally flat with moderately to well-drained sandy soils created by the ancient shoreline of the Atlantic Ocean.

Soil types can impact building foundations, drainfields, design of drainage systems and the ability to install low impact design features. In addition, wetland areas are generally characterized by hydric soils which are soils formed by periodic or sustained saturation of water. Wetlands regulations impact development design.



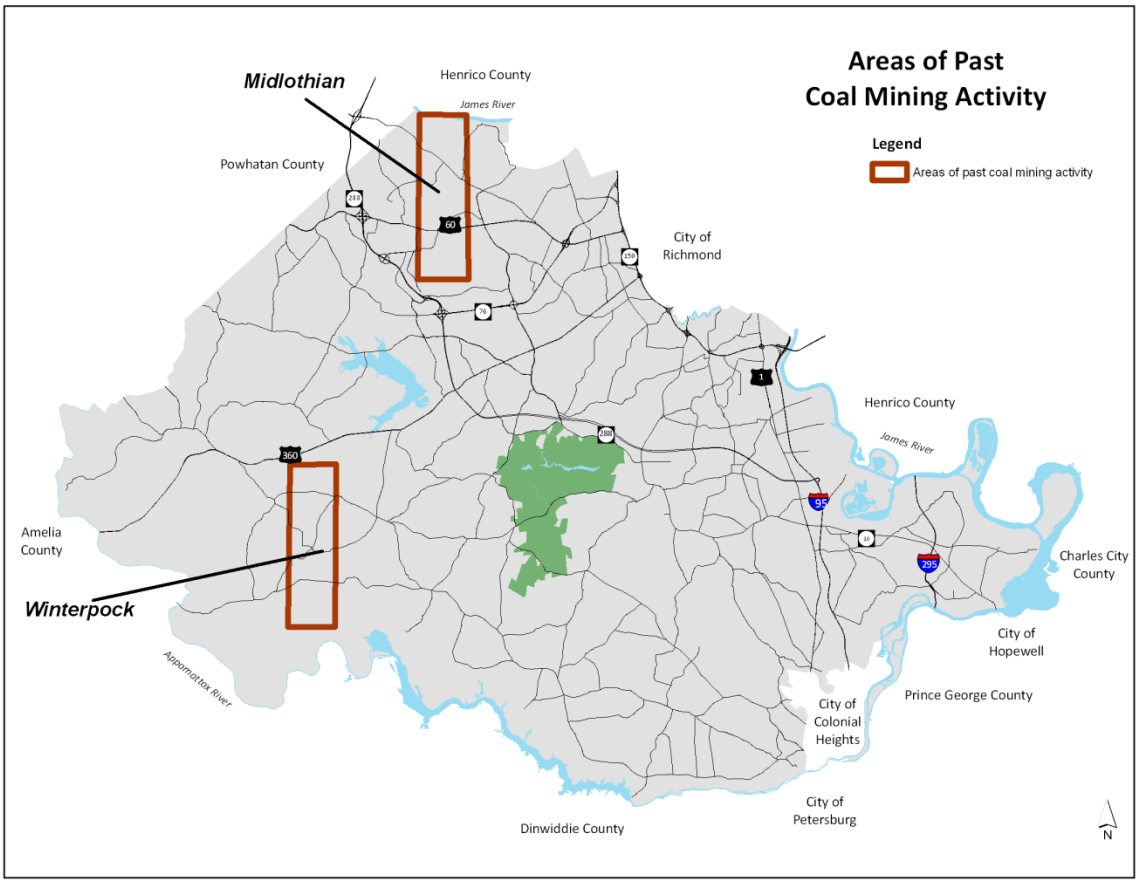
MINERAL RESOURCES

Mineral resources can be categorized into fuel resources, such as coal and natural gas and non-fuel resources such as sand and gravel mining. While the first commercial coal production in America occurred in Chesterfield County, coal is no longer actively mined in the county. One of the mineral resources mined in the county today is granite.

Fuel Mineral Resources

Coal Mining

Major coal mining production in the county ceased in 1927, leaving many abandoned mines and shafts in the vicinity of the Midlothian and Winterpock areas.



Natural Gas Extraction

Black shale and coal beds exist in the Richmond Triassic Basin and the Dutch Gap area. These areas contain natural gas. In the late 1970's and early 1980's, approximately 20 wells were drilled in the county to test these formations to determine the feasibility of producing natural gas. While several of the exploratory wells were capable of producing natural gas, there was too much water in the wells to make extraction viable. The wells were subsequently capped in accordance with state and county requirements.

Non-Fuel Mineral Resources

Mining of clay, sand and granite is an active part of the county's economy. Mining industries support development activities. These operations are regulated by the Virginia Department of Mines, Minerals and Energy (DMME), the US Department of Labor's Mine Safety and Health Administration (MSHA), as well as by zoning requirements. DMME regulates four mine permits in Chesterfield County, with active mining operations currently underway at three of these sites. The land acreage under permits is approximately 612 acres. Three of the mines are permitted to produce crushed stone for construction aggregate from the Petersburg Granite (Mpg), while the fourth operation is permitted to produce sand and clay, also for the construction industry. Annual production reports indicate a total of about 1.3 million short tons of crushed stone were produced in 2016, with an estimated value of about $21.4 million. There were a total of 31 workers directly employed by the mining companies in 2016 earing approximately $1.6 million in wages. A map of all active and past mining permits can be found on the DMME website.

Mineral extraction also creates spin-off jobs in transportation and related industries.

FOREST AND FARMLAND

Forest

The Virginia Department of Forestry defines forest as "a plant community in which the dominant vegetation is trees and other woody plants." In Virginia, forests consist primarily of pines and hardwoods. Over the years, the amount of forestland has decreased primarily due to development. The forested nature of the county provides both an economic and aesthetic benefit. Forests provide recreation opportunities, maintain wildlife habitats, create natural reserves and preserve water quality. In addition, timber harvesting is an active industry in the county; the value of the timber sold in 2015 was approximately $3.4 million. Timbering activities supply products to regional paper and lumber manufacturers.

Based upon 2015 information from the Virginia Department of Forestry:

- Approximately 152,671 acres of forest (55% of the county's land area) exist in the county.
- Approximately 134,035 acres of forest in the county (87% of all forest) are privately owned.
- Of the 95 counties in Virginia, the county ranked 35th in value of timber sold and 33rd in terms of volume of timber cut.

Farmland

For purposes of zoning, Chesterfield County defines a farm as a tract of land used for raising agricultural products, but excluding a farm winery; or tract of land on which is kept one or more cows, sheep, goats, horses, chickens, other fowl, rabbits, other farm animals or other small domesticated livestock. There is no definitive source of information regarding the total number of farms and the amount of acreage actively farmed in the county. Farming information can, however, be derived from a variety of sources such as the Census of Agriculture, the county's Land Use Program and the James River Soil and Water Conservation District (District).

In 2012, the Census of Agriculture reported that the market value of agricultural products sold by county farms totaled approximately $6.4 million. It is also worth noting that farmer's markets are becoming increasingly popular in the county. Further, opportunities exist for the partnering of area farmers and food manufacturers to grow and produce food within the county.

Based upon 2012 information from the Census of Agriculture:

- Approximately 6,900 acres are dedicated to cropland farming (2.6% of the county's land area) producing mainly barley, wheat, hay and corn.
- Livestock production is active and includes cows and calves, chickens, hogs and pigs, goats and alpacas. The amount of land in this category is unknown.
- Other farmland activities focus on equestrian boarding and training, nursery production, and vineyards.

The District provides cost share and tax credit incentives through their Agriculture Best Management Practice program to producers in Chesterfield County. Each year the District has funding available to qualifying producers to help improve thousands of acres of land. This funding provides incentives for improving soil and water quality in the Chesapeake Bay watershed. The District also implements the Virginia Conservation Assistance Program that offers financial assistance to homeowners to promote urban conservation to reduce sediment and nutrient inputs into local waterbodies and the Chesapeake Bay.

As of 2017, approximately 3,600 acres of farmland (agriculture and horticulture) properties are enrolled in the county's Land Use Program.

Some farming may take place in the water to raise fish, shellfish or aquatic plants. There are no known commercial fisheries in Chesterfield County. Aquaculture may take place on private farms and aquaculture research is being performed at Virginia State University.

Urban Agriculture

The field of urban agriculture is also an important type of farming and can take advantage of underutilized properties in urban or suburban settings that may be too small to support traditional farming. Urban farming provides education, health, social and economic benefits to local communities. To increase these benefits in the county, there are numerous local and regional markets such as restaurants, community supported agriculture (CSA) and farmers' markets that could be explored in partnership with research at Virginia State University.

County Land Use Program - Existing Incentives for Forestland and Farmland Preservation

As of January 2017, approximately 60,000 acres of forestland and farmland (21% of the county's land area) were included in the county's Land Use Program. This voluntary program was established by the ***Code of Virginia*** to "promote the preservation of land for public benefit." The program provides tax relief to landowners whose property meets certain size criteria, and is used for agricultural, horticultural, forestal and open space uses. A landowner pays taxes on the assessed

value of the land based on use rather than market value. To incentivize landowners to preserve their properties in their natural state, the Land Use Program assesses a tax, known as a rollback tax, on the property owner in certain circumstances when the land use intensifies, the size of the property is decreased below the minimum acreage required for the program, or the property owner rezones the property to a more intensive use.

CONSERVATION LANDS

Approximately 17,000 acres (6% of the county's land area) are owned by local, state and federal governments as parks and research lands or are protected under conservation or open space easements. The character of these areas varies from woods and wetlands to active playing fields.

Parks

Chesterfield County is home to Pocahontas State Park, the largest state park in Virginia, comprising nearly 8,000 acres, as well as three federal parks totaling 1,400 acres. These federal conservation lands include Presquile National Wildlife Refuge, and two areas within the Richmond National Battlefield Park System, Parker's Battery and Drewry's Bluff. The county owns numerous regional, community, neighborhood and special purpose parks providing both passive and active recreational opportunities and comprising 4,600 acres. The county park system is discussed in more detail in The Public Facilities Plan chapter.

Research Lands

State universities own two properties used primarily for agricultural and environmental research in the county. The 400-acre Randolph Farm is an agricultural research facility operated by Virginia State University (VSU) and located in Ettrick along the Appomattox River. Virginia Commonwealth University (VCU) owns 140 acres of property adjacent to the James River in the Meadowville area. The VCU property is an extension of the VCU Rice Center for Environmental Life Sciences, located downriver in Charles City County. The VCU Rice Center specializes in river ecology studies.

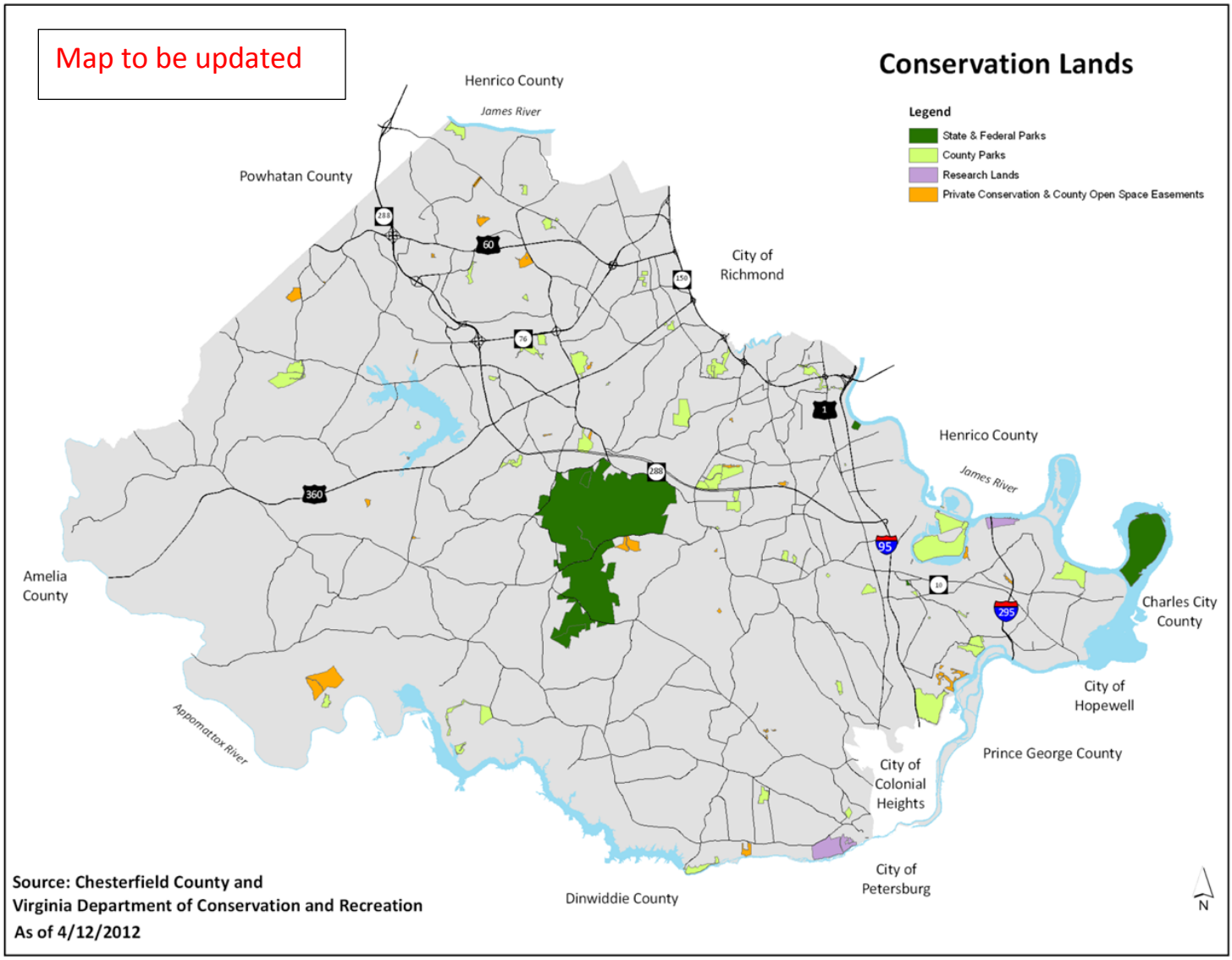
Conservation and Open Space Easements

Landowners can benefit from federal and state tax programs by voluntarily placing conservation and open space easements on their property. Conservation easements are an agreement between a landowner and a qualified land protection organization, often called a land trust. Open space easements are an agreement between a landowner and a public body, including state agencies, local governments and soil and water conservation districts, among others. In addition, local

governments are authorized to acquire and designate property for preservation as open space land by assuming ownership of the property.

Conservation easements protect land in perpetuity from future development. A landowner enters into agreement with an organization to hold the easement, which is recorded with the property deed and runs with the land. Open space easements must last for a minimum of five years, but may also be perpetual. Easement agreements vary from property to property. The use of the property is limited, but continued farming and forestry operations may be allowed. The use of the property under the easement or agreement must conform to the county's comprehensive plan.

Approximately 2,600 acres of private land in the county are protected under conservation easements or open space easements. Of the county's 4,600 parkland acres, approximately 1,500 acres are held in conservation easements. In addition to easements, some parkland is protected by deed restrictions and covenants.



NATURAL HERITAGE RESOURCES

The Virginia Natural Area Preserves Act defines natural heritage resources as "the habitat of rare, threatened, or endangered plant and animal species, rare or significant natural communities of geological sites, and similar features of scientific interest." The Virginia Department of Conservation and Recreation's Division of Natural Heritage and the Virginia Department of Game and Inland Fisheries document natural heritage resources.

When permits are required to disturb wetlands, developers are required to provide an inventory of the site's natural heritage resources in conjunction with the permit application. Through the state and federal permitting processes, determinations are made as to what measures, if any, must be taken to protect any identified natural heritage resources.

Some of the county's natural heritage resources include:

- The barking treefrog (*Hylas gratiosa)* – listed by the State as a threatened species
- The yellow lampmussel (*lampsilis cariosa*)
- Atlantic sturgeon (*Acipenser oxyrinchus*) – listed by the U.S. Fish & Wildlife Service and the State as an endangered species
- The Ohio river shrimp (*Macrobrachium ohione*) – prioritized for protection by the State as critically imperiled because of extreme rarity
- Tidal freshwater marsh – prioritized for protection by the State as uncommon but not rare
- Virginia least trillium (*Trillium pusillum var. virginianum*) – listed by the U.S. Fish & Wildlife Service as a species of concern and prioritized for protection by the State as imperiled because of rarity

Relationship between Land Resources & Development Infrastructure

FOUNDATIONS

Building foundation designs can be impacted by soil types. The county's Department of Building Inspection addresses building foundation designs in areas with soils that shrink when dry and swell when wet. The U. S. Department of Agriculture maintains the Web Soil Survey that provides maps of all soil types.

PRIVATE INDIVIDUAL ON-SITE WASTEWATER TREATMENT

Soils and topography affect the ability to install drainfields for private individual on-site wastewater treatment facilities. Installation of a private system must be approved by the Chesterfield County Health Department. All private conventional and alternative onsite sewage systems shall be maintained

(including pump-out or inspection requirements) in accordance with county code and state regulations as noted on plats.

The eastern area of the county is generally suitable for the installation of conventional septic systems. Soils in the western area of the county, especially in the Triassic Basin, are generally unsuitable for conventional systems (see map on page EN 3). Where soils are not suitable for conventional systems, alternative on-site septic systems may be installed. These alternative systems process waste for an individual residence.

Approximately 23,500 county residences are on a private individual conventional septic system. The average lifespan of a conventional system is 35 years. The county requires that these systems be pumped out every five years. Current regulations require sufficient acreage and soil conditions that can accommodate a reserve drainfield for a conventional system.

Approximately 730 county residences are on an alternative on-site septic system. An alternative on-site system does not require as much land area as a conventional system. The initial cost for installation of an alternative on-site septic system is higher than that of a conventional system due to the treatment unit and each individual system must be designed by a professional engineer or alternative onsite evaluator. Alternative on-site septic systems also have higher annual maintenance costs due to their complexity.

Impacts of Specific Land Uses on Land Resources and Development

Existing and new development can be impacted by activities that use, or have used, land resources. These activities include coal mines, mineral extraction and landfills. When abandoned and reclaimed, some of these areas also have the potential for adaptive reuse such as sites for alternative and renewable energy.

COAL MINES

DMME manages an Abandoned Mine Lands program to assist in locating and characterizing the hazards associated with abandoned coal mining activities.

Development in the vicinity of abandoned coal mining activities must be sensitive to the potential existence of shafts which can cause sink holes in the earth. Therefore, careful attention must be given to the placement of structures in relationship to past mining activities.

The county maintains maps showing approximate locations of abandoned mines and shafts. This information is used when reviewing development proposals in the vicinity of past coal mining activities and recommendations are made accordingly through the development review process.

FUEL AND NON-FUEL MINERAL RESOURCE EXTRACTIONS

DMME permitting and the county's zoning and development review processes regulate mineral extraction activities in the county. While extractions provide an economic benefit, the activity can impact nearby land uses.

Impacts and reclamation of extractions are addressed through the zoning for a property and the development review process. Impacts from active operations could include dust, noise and vibration from blasting and crushing. Residential uses are especially vulnerable to these impacts. Closed sites should be properly secured and reclaimed.

LANDFILLS

Landfills are sites for the disposal of waste and are regulated by the Virginia Department of Environmental Quality. The county also regulates landfills through zoning, the development review process and by county ordinance. There are three types of landfills:

- Sanitary landfills, which accept household, business and industrial waste
- Construction/demolition/debris landfills, which accept land cleared material and construction debris
- Hazardous waste landfills, which are treatment, storage and disposal facilities for hazardous waste

The Central Virginia Solid Waste Management Plan was submitted to DEQ by the Central Virginia Waste Management Authority (CVWMA). DEQ approved the plan on May 31, 2015. The CVWMA is a public service authority for solid waste and recycling for thirteen local governments in central Virginia, including Chesterfield County. The plan defines solid waste management objectives for the service area and also provides an inventory of all active and closed solid waste facilities in the service area.

Impacts and reclamation of landfills are addressed through the zoning and development review processes. Impacts from active operations could include dust, noise, water pollution and odor. Active and closed landfills generate methane gas and leachate. Residential uses are especially vulnerable to these impacts. Closed landfills must be properly secured and stabilized in accordance with applicable legal requirements.

Air Quality

Air quality is influenced by many elements from a wide geographic area. For example, the air quality of Chesterfield County is affected not only by personal daily actions such as operating a motor vehicle, but also by the emissions of major industries located hundreds of miles away. National Ambient Air Quality Standards are set by the Environmental Protection Agency and air quality is monitored by the Virginia Department of Environmental Quality. Outdoor, or ambient, air is monitored for five pollutants: carbon

monoxide, sulfur dioxide, nitrogen dioxide, ozone and particulate matter. Ozone, the primary component in smog, directly impacts citizens' health, particularly those with asthma or emphysema.

Air quality is measured at a regional scale and has steadily improved since 2012 due to collaborative efforts by community leaders. The Richmond region includes Chesterfield County, as well as the counties of Charles City, Hanover, Henrico, Prince George and the cities of Colonial Heights, Hopewell, Petersburg and Richmond. Two of the regional monitoring stations operated by the Department of Environmental Quality are located in the county: one at Beach and Spring Run Roads which collects data on ambient ozone levels and one at the Defense Supply Center on Jefferson Davis Highway which collects data on particulate matter. On May 21, 2012, EPA designated the Richmond region as attainment/maintenance for the 2008 ozone National Ambient Air Quality Standards, which means the area is meeting the applicable air quality standard. In 2013, leaders from the region developed an action plan to promote ongoing good air quality. A 2017 update to the action plan indicates that air quality improvements are continuing in the region due to increases in ridesharing, investment in renewable energy and a reduction in coal-powered electricity.

Noise

Noise pollution is considered unwanted, disturbing, disagreeable or unpleasant sound. There are two types of noise:

- **Background sounds** such as those created by traffic and mechanical equipment
- **Short-term sounds** such as those created by construction, animals, refuse collection, airports railroads and outdoor events.

EPA regulates noise sources such as rail and motor carriers, construction equipment, transport equipment, trucks and motorcycles. Noise generation can also be regulated at the local level.

The Land Use Plan chapter considers noise impacts by discouraging incompatible land uses in close proximity. Further, The Land Use Plan chapter discourages residential uses in areas impacted by the Chesterfield County Airport.

The County Code addresses short-term noise disturbance such as those from garbage collection, radios, televisions, loud speakers and lawn maintenance. The Zoning Ordinance also addresses potential noise impacts through setback and buffer requirements and, in some districts, limitations on hours of operation. Through the zoning process, conditions may be considered to address the potential noise impacts of a specific development proposal.

Light

Light pollution is the alteration of outdoor light levels due to manmade sources of light. Improperly directed or unshielded light can create a nuisance.

The Zoning Ordinance addresses light pollution, requiring light sources to be directed downward; preventing direct view of light sources from public rights of way and residential properties; limiting light intensity; and, in some instances, requiring buffers. Through the zoning process, conditions may be considered to address the potential light impact of a specific development proposal.

Water Resources

GROUNDWATER

Groundwater is the water beneath the surface of the earth, and is an important resource for domestic and industrial use. Groundwater is stored in underground formations known as aquifers. Wells are one way to remove groundwater from aquifers. Soil, rock, precipitation and topographical conditions impact the ability and rate of an aquifer to recharge, which is the natural ability of an aquifer to refill with water. Overpumping and overuse of groundwater can lead to the failure of an aquifer and the permanent loss of that water resource.

Aquifers in the Piedmont, Triassic Basin and Coastal Plain have separate and unique characteristics. Generally, wells in the Coastal Plain recharge quickly due to sandy soil conditions, whereas wells in the Triassic Basin do not recharge as rapidly due to rock formations that impede the flow of water into the aquifer. Also, due to rock formations in the Triassic Basin, it is often necessary to drill deep wells and/or to drill at several locations before finding an adequate water supply. In some instances, it is also necessary to have several wells on an individual site to obtain an adequate water supply. Aquifers are subject to pollution from infiltration of stormwater, surface water and contaminants that are dumped onto the ground's surface and filter down into the groundwater.

In Chesterfield County, only residents with private wells obtain drinking water from groundwater. Groundwater in the county is also pumped and used for industrial purposes. Installation of a drinking water well must be approved by the Chesterfield Health District. Approximately 9,000 county residences are on private wells. A residential well must yield a minimum of three gallons per minute to meet county requirements. For any newly created parcel, the county requires a minimum lot size of one acre for the installation of a residential well.

Some of Chesterfield County's groundwater is located in the Eastern Virginia Groundwater Management Area, one of only two groundwater management areas in the state. This Area was created to conserve the use and protect the quality of the groundwater for all areas east of Interstate 95. In 2015, the General Assembly established the Eastern Virginia Groundwater Management Advisory Committee to develop, revise and implement a management strategy for groundwater in the Eastern Virginia Groundwater Management Area. The county submitted a water resource plan in support of the committee's efforts.

SURFACE WATER

Surface water includes wetlands, streams, lakes, springs, ponds and rivers. Chesterfield County has 92 miles of waterfront along the James and Appomattox Rivers. Twelve of the 92 miles are along Lake Chesdin, created by a dam on the Appomattox River. Approximately 19 miles of the Appomattox River from the Brasfield Dam at Lake Chesdin to where it meets the James River (excluding the Port Walthall Channel) have been designated by the state as a scenic river. This designation recognizes the natural, scenic,

historic and recreational value of this portion of the river and does not imply any land use controls or public access. In addition, thousands of miles of streams exist in the county, as well as hundreds of lakes and ponds. County surface water drains to the James River, which ultimately flows to the Chesapeake Bay. County surface waters are protected by regulation of development activities to control erosion, sediment and stormwater, as well as preserve sensitive buffer areas adjacent to streams and wetlands. County surface waters are also protected under a permit issues to the county by DEQ, which requires oversight of the county's storm sewer system to prevent pollutants from ultimately discharging to our local creeks and rivers. The county also addresses issues of stream and shoreline erosion through the development process. In addition, the county actively works with property owners to address water quality issues following development.

DOCKS AND PIERS

Docks and piers are structures built out into the water that allow public or private access to water bodies for safe recreational access such as fishing , swimming or boating. Pillars are submerged into the bottom of the waterbody. Docks and piers are considered water dependent uses and are permitted under the Chesapeake Bay Act. Installation of such structures can prevent shoreline erosion for areas with high use, but must be built with proper design and materials to limit impacts. In addition to impacts from improper materials, structures can also displace aquatic vegetation and introduce shade to waterbodies. The county regulates the permitting of shoreline structures along Swift Creek Reservoir. The Virginia Marine Resources Commission and the Appomattox River Water Authority in coordination with the county regulate the permitting of shoreline structures along Lake Chesdin.

DRINKING WATER SOURCE WATERSHEDS

Swift Creek Reservoir, a source of drinking water, is a 1,700 acre water amenity. The Reservoir is maintained by the Department of Utilities. More information regarding the Swift Creek Reservoir as a drinking water source is found in the Water and Wastewater chapter.

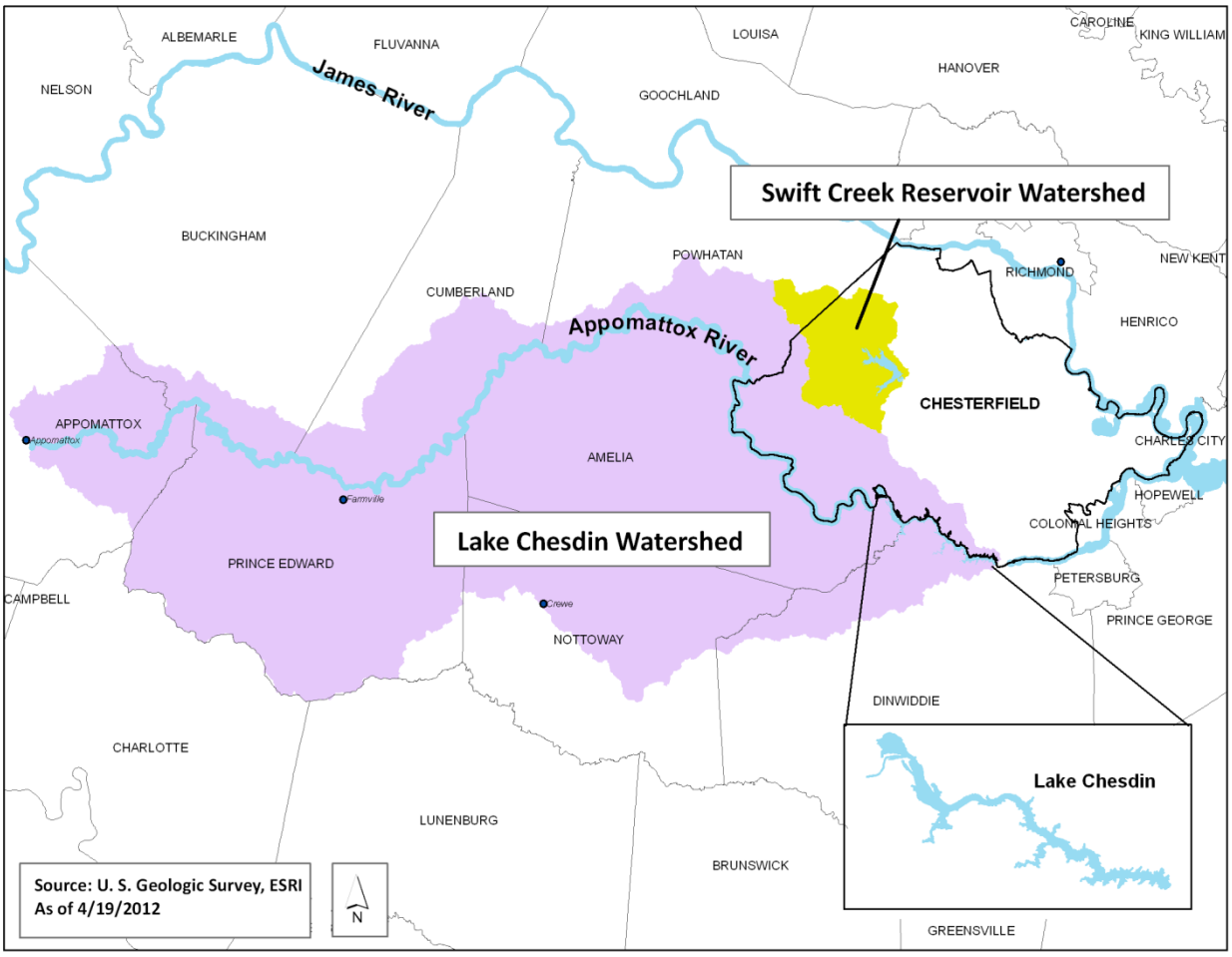
Lake Chesdin, a source of drinking water, is a 3,100 acre water amenity. The Lake is maintained by the Appomattox River Water Authority. More information regarding Lake Chesdin as a drinking water source and the Appomattox River Water Authority is found in the Water and Wastewater chapter.

Until 1985, Falling Creek Reservoir was used as a drinking water source. A combination of water quantity and quality issues made it no longer cost effective to use it as a drinking water source. Falling Creek Dam is maintained by the Department of Utilities.

In addition to Swift Creek Reservoir and Lake Chesdin, the James River is a third drinking water source for the county. These resources also provide aesthetic and recreational benefits. Drinking water supply and capacity are critical to the growth and development of the county. Legal requirements that protect

surface water and groundwater are discussed in this chapter. The county strives to ensure an adequate supply of drinking water. The Water and Wastewater chapter contains a comprehensive discussion of water supply demand and projections of the county's water needs.

The Swift Creek Reservoir Watershed comprises approximately 40,000 acres. Approximately 33,000 acres (or 83%) of the watershed lie within the county's boundaries. This enhances the county's ability to protect water quality in the reservoir through proactive measures. The remaining portion of the watershed lies in Powhatan County.
The Lake Chesdin Watershed comprises approximately 854,000 acres. Approximately 65,500 acres (or 8%) of the watershed lie within the county's boundaries, limiting the county's ability to significantly affect the water quality of the reservoir. Lake Chesdin is controlled by the Appomattox River Water Authority of which the county is a member. Further discussion of the role of the Authority is outlined in the Water and Wastewater chapter.



FLOODPLAINS

Floodplains are areas of land along rivers or streams that are periodically flooded as result of precipitation, snow melt and stormwater. Floodplains provide storage capacity for excess water until downstream surface water systems can adequately accommodate the flow. Floodplains that are left in their natural state benefit water quality by providing a buffer between development and the water

body. The county's floodplain map was updated by the Federal Emergency Management Agency in 2012. The Zoning Ordinance restricts construction in floodplains to prevent the loss of life and property. Clearing in floodplains that are part of a Resource Protection Area is also limited by the Zoning Ordinance. For areas within the Upper Swift Creek Watershed, clearing in floodplains adjacent to non-Resource Protection Area streams is also limited by the Zoning Ordinance.

WETLANDS

The United States Army Corps of Engineers and DEQ define a wetland as "areas inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and under normal conditions do support, a prevalence of vegetation typically adaptive for life in saturated soil conditions. Wetlands generally include swamps, marshes and bogs." Wetlands provide numerous environmental services. They filter pollution, mitigate flooding, provide a source of groundwater recharge and provide habitat for diverse wildlife and plants. Chesterfield County wetlands are protected under the Zoning Ordinance, the stormwater ordinance, the erosion and sediment control ordinance, as well as by laws and regulations administered by the Army Corps and DEQ. The Army Corps and the DEQ review and issue permits for disturbance of wetlands. These permits may require mitigation of impacts through stream restorations, provision of compensating wetlands elsewhere, or purchase of credits from an Army Corps or DEQ approved wetlands mitigation bank. The county's regulation of wetlands is discussed in more detail below.

Impacts of Human Activities on Water Resources

Water pollution means the alteration of the chemical, physical or biological properties of state and local waters that creates a nuisance, harms the public or the environment, or renders such waters unfit for their designated use. Most water quality pollution comes from either "point" or "non-point" sources.

Point sources of pollution come from an identifiable source such as a pipe outlet from a wastewater treatment plant or industrial use. These discharges are regulated through the Virginia Pollution Discharge Elimination System permits, which are issued by the state and place limits on the allowable types and amounts of pollutants that may be discharged to state and local waters.

Non-point sources of pollution do not come from an easily identifiable point of discharge. Non-point source pollution occurs when pollutants accumulated on land runoff to surface waters during rain events. Impervious areas, solid surfaces that resist water penetration, contribute to non-point source pollution by causing water to flow in greater volumes and increased speed into stormwater drainage systems and streams. Increased volumes and faster water flows adjust the shape of streams by widening or down-cutting the stream bed and eroding banks. These adjustments degrade aquatic habitat for animals and plants. Stormwater runoff from roads and other paved surfaces also impacts water quality by washing pollutants into local waterbodies. Pollutants include motor oil, pesticides, toxic substances, animal waste, pathogens and soils from construction sites. These pollutants can adversely affect aquatic organisms and fish. Nonpoint source pollution is addressed by the EPA, DEQ and the county through a combination of stormwater requirements and voluntary programs.

A variety of uses and activities generate pollutants that impact water resources:

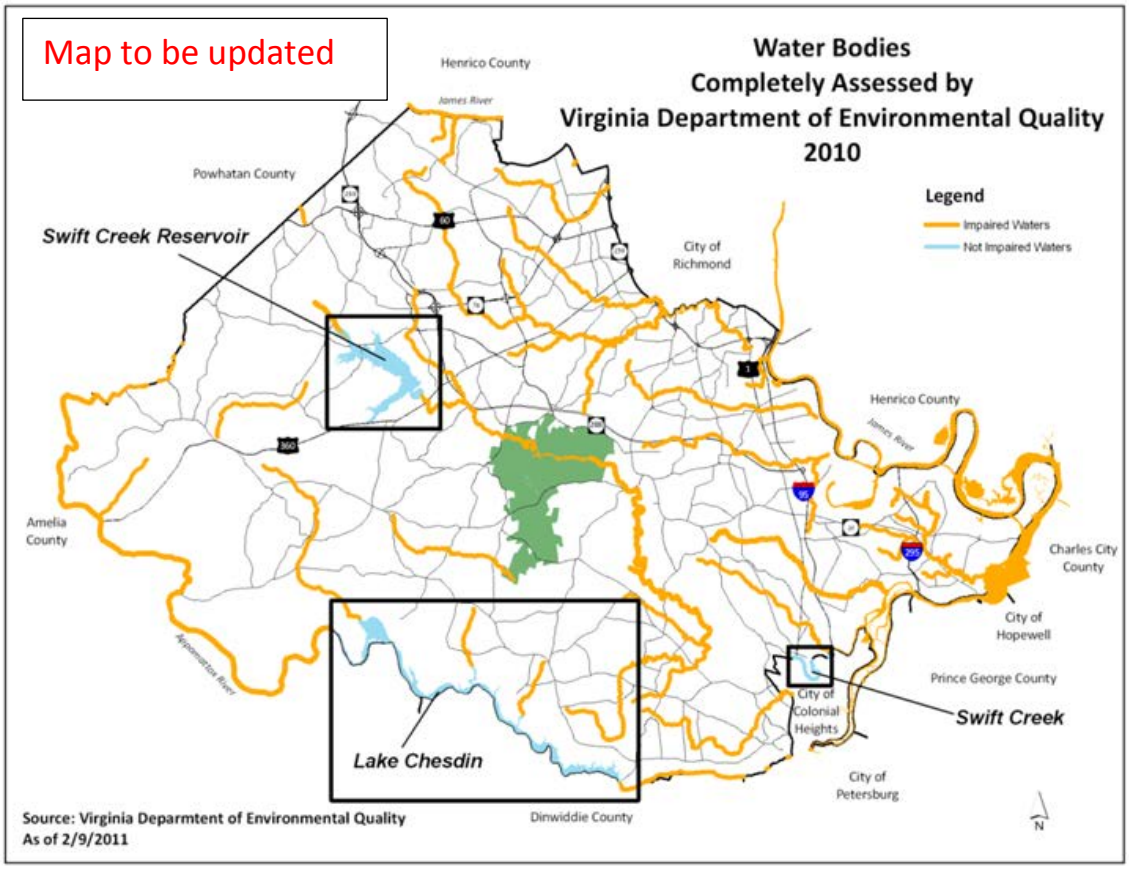
- **Land uses:** fertilizers, pesticides, metals, oil, grease and animal waste
- **Construction Sites**: sediment and petroleum
- **Agriculture:** fertilizers, animal waste and sediment
- **Silviculture or Timbering:** sediment
- **Roads and Parking Lots:** de-icing products, metals petroleum and sediment
- **Golf Courses:** fertilizers, pesticides and herbicides
- **Marinas and Boat Ramps:** petroleum, sewage, trash and sediment
- **Failing Septic Systems:** bacteria and nutrients
- **Discharges to Storm Sewers or Land:** fertilizers, petroleum and detergents
- **Landfills:** groundwater leachate and surface runoff
- **Hazardous Waste**
- **Underground Storage Tanks:** petroleum
- **Stream Bank and Shoreline Erosion:** sediment and vegetation loss.
- **Brownfield and Superfund Sites:** petroleum, chemicals, hazardous waste

IMPAIRED STREAMS, LAKES AND RIVERS

DEQ assesses water quality of the state's streams, lakes, reservoirs and rivers to determine if they are safe for recreation, fishing, wildlife habitat and harvesting shell fish for eating. Further, water bodies used for public drinking water are also assessed. An interactive map of the impaired waters in Chesterfield County can be viewed on the DEQ Geographic Information System (GIS) Application.

A water body is considered impaired if any of the following conditions are found:

- It fails water quality standards
- Fish or shellfish are contaminated
- Nutrient levels are high
- Aquatic life is declining.



Legal Requirements for the Protection of Water Quality

Water quality requirements and monitoring programs are in place to protect water quality from point and non-point source pollution.

FEDERAL CLEAN WATER ACT (CWA)

In accordance with the *Federal Clean Water Act*, Virginia has adopted water quality standards to restore and maintain the chemical, physical and biological integrity of the nation's waters. In Virginia, these standards are administered by DEQ under the authority of the State Water Control Law. Pollution control programs include establishing and updating water quality standards, identifying polluted water bodies, protecting wetlands and the issuing discharge permits.

VIRGINIA POLLUTION DISCHARGE ELIMINATION SYSTEM (VPDES) AND VIRGINIA WATER PROTECTION PERMIT (VWP)

The Virginia Department of Environmental Quality regulates water resources and pollution. Various permits are required to regulate uses that have the potential to impact water quality, such as industrial activities, wastewater treatment plants, biosolids applications and livestock feeding operations.

STORMWATER MANAGEMENT

DEQ regulates stormwater through the Virginia Stormwater Management Program (VSMP) and delegated its VSMP authority to the county in 2014. The purpose of this program is to issue permits that authorize the discharge of stormwater during land disturbing activities. These permits require the implementation of measures to control and manage stormwater and reduce the pollutants discharged to state and local waterbodies.

In 2014, county ordinance was amended to include the VSMP. The VSMP requires plan review to meet water quantity and quality requirements and inspections during the land disturbance construction process to ensure water quality protection. The program also requires the long-term responsibility for maintenance of stormwater facilities.

Stormwater discharges from county maintained infrastructure is regulated by DEQ under a Municipal Separate Storm Sewer System (MS4) permit, which was re-issued December 17, 2014 and is valid for five years. The MS4 permit requires a series of programs to reduce the discharge of pollutants from the storm sewer system in a manner that protects water quality of nearby streams, rivers, wetlands and the Chesapeake Bay.

Chesapeake Bay Total Maximum Daily Load (TMDL)

Because the county's local waters ultimately wind up in, and impact, the Chesapeake Bay, the MS4 permit contains a special condition for the Chesapeake Bay. This special condition requires the county to reduce stormwater discharge of nitrogen, phosphorus, and total suspended solids to the Chesapeake Bay. Chesterfield County has developed a compliance plan to achieve the required reductions. This includes stream restoration, restoration of the Falling Creek Reservoir and retrofitting existing stormwater treatment facilities.

EROSION AND SEDIMENT CONTROL ORDINANCE (ESC)

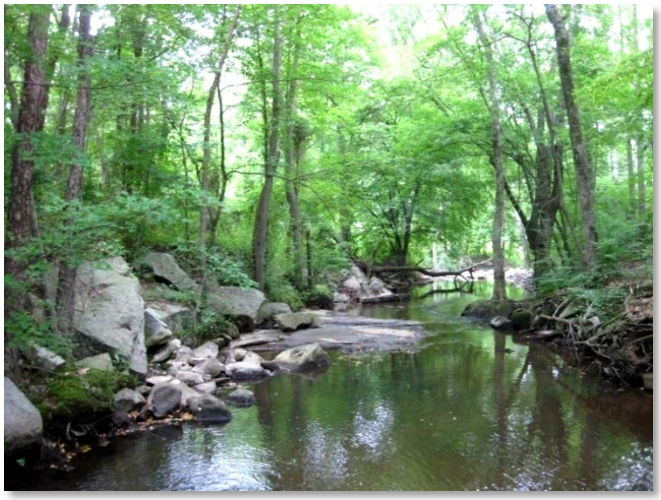
The goal of the Virginia State Erosion and Sediment Control Ordinance is to control soil erosion, sedimentation and nonagricultural runoff from regulated "land-disturbing activities" to prevent degradation of property and natural resources. The county implements the Virginia State Erosion and Sediment Control Ordinance. The regulations specify "Minimum Standards" which include criteria, techniques and policies that must be followed for all regulated activities. These standards address

erosion and sediment control measures as well as control stormwater runoff to ensure that the limits of 100 year floodplains will not be exceeded on roads and storm sewer structures.

In 2016, the General Assembly amended the State Water Control Law, the Erosion and Sediment Control Law and the Chesapeake Bay Preservation Act to consolidate the stormwater management and erosion and sediment control programs. DEQ is drafting new regulations to implement the consolidated program.

CHESAPEAKE BAY PRESERVATION ACT

The Chesapeake Bay Preservation Act ("Act"), adopted in 1988, is designed to protect and improve water quality in the Chesapeake Bay and its tributaries by requiring the use of effective conservation planning and pollution prevention practices when using and developing environmentally sensitive lands. The two types of Chesapeake Bay Preservation Areas are Resource Protection Areas ("RPA") and Resource Management Areas ("RMA"). The entire county has been designated as an RMA.



The county is subject to the Act and has, therefore, regulates post-development phosphorous runoff from individual sites to 0.45 pounds per acre per year. Development in an RMA must address water quality protection through preservation of native vegetation to the maximum extent possible, limiting disturbance area during construction to that necessary to accommodate the proposed use and minimizing the amount of impervious cover through the use of best management practices. Development within an RPA is limited to passive recreational uses, public roads and utilities, water wells, historic preservation and archeological activities. All other development proposed within a RPA is prohibited unless an exception is granted administratively or by the Board of Supervisors.

- RPAs include a minimum
  - water bodies with perennial flow
  - tidal wetlands
  - tidal shores
  - nontidal wetlands connected by surface flow that are contiguous to tidal wetlands or water bodies with perennial flow
  - other lands determined by the county to be sensitive to impacts which may cause significant degradation to the quality of state waters; and
  - A minimum 100-foot naturally vegetated buffer adjacent to and landward of these components.

RPAs serve an important water quality function by protecting county waterbodies and providing a buffer adjacent to them. The buffer acts to filter runoff prior to entering water bodies. Using site-specific evaluations, the county updates maps showing RPAs. A map depicting the current extent of the RPAs in Chesterfield County can be found online at GeoSpace.

Best Management Practices (BMPs) are structural and non-structural methods designed to remove pollutants from runoff, and minimize flooding and stream channel erosion resulting from development. Best Management Practices can include both wet and dry ponds, drainage swales, sand filters, infiltration trenches and manufactured systems.

UPPER SWIFT CREEK WATERSHED REGULATIONS

In addition to Chesapeake Bay protection measures, the county adopted additional practices designed to address development activities within the Upper Swift Creek watershed for the purpose of protecting the water quality of Swift Creek Reservoir, a source of the county's drinking water. Primarily the regulation limits residential subdivision development to a post-development phosphorous load of 0.22 pounds per acre per year. Compliance with this requirement could include:

- Preservation of vegetation, soils and wetlands
- Use of natural drainage features and patterns
- Use of low impact site design techniques
- Use of Best Management Practices.

In conjunction with any zoning application in the Upper Swift Creek Watershed, the Zoning Ordinance requires the submission of a Natural Resource Inventory which is an assessment of a site's natural resources such as wetlands, floodplains, steep slopes, hydric soils, habitats, endangered species and other notable features. The inventory is used to assess appropriate design measures that should be taken to protect the reservoir's water quality.

Hazard Mitigation

Many of the programs and regulations discussed in this chapter are aimed at protecting and improving environmental quality but also aid in hazard mitigation efforts to reduce the loss of life and property by lessening the potential impact of future disasters. Chesterfield County must focus on long-term sustainability by identifying short and long term impacts associated with natural events. The 2016 Richmond Crater Multi Regional Hazard Mitigation Plan recommends specific actions designed to protect residents, business owners and the built environment from hazards that pose the greatest risk. A comprehensive mitigation approach addresses hazard vulnerabilities that exist today and in the foreseeable future. Therefore, projected patterns of future development must be evaluated and

considered in terms of how that growth will increase or decrease a community's hazard vulnerability over time.

This Mitigation Plan is currently in the process of being updated and rewritten with expected adoption in late 2017. Care should be taken to ensure consistency between the Comprehensive Plan and the Regional Hazard Mitigation Plan. Recommendations in the plan are designed to protect residents, business owners, and the built environment from hazards that pose the greatest risk. These recommendations can be applied to reduce a community's future vulnerability by identifying hazards and enacting local policies to guide growth and development, providing incentives tied to natural resource protection, and providing public awareness and outreach activities.

General Environment Guidelines

The General Environment Guidelines provide direction for development and land use decisions as they relate to environmental resources.

Major considerations in the development of these guidelines include:

- ❖ Acknowledging existing regulations regarding water quality, floodplains and soils.
- ❖ Promoting protection of land, surface water and groundwater resources for drinking, aesthetic and recreational purposes.
- ❖ Encouraging the incorporation of environmental resources as amenities in new development.
- ❖ Supporting adaptive reuse of land resources formerly occupied by activities such as quarries and landfills.

The following General Environment Guidelines should be used when addressing environmental protection:

- ➢ **Development Integration of Environmental Resources.** Encourage development designs which accommodate and incorporate environmental resources as amenities.

- ➢ **Innovative Development.** Encourage innovative approaches, designs and practices that protect and enhance environmental resources in new developments. When the guidelines of The Land Use Plan chapter are followed, approaches could include: reduced lot sizes in return for preservation of open space; connectivity of resources; and appropriate recreational uses that make use of these resources.

- ➢ **General Development Standards.** Encourage use of innovative development standards and practices that mitigate the impact of stormwater runoff on water quality such as:
  - Low impact design features
  - Limitations on the amount of land cleared during site development at any given time
  - Retrofitting best management practices in older neighborhoods
  - Use of manufactured best management practices
  - Use of best management practices in series
  - Minimize impervious surfaces
  - Development of contingency plans for hazardous spills
  - Preservation of trees
  - Preservation of vegetation in floodplains.

- ➢ **Land Use Transitions.** For developments not located within mixed use areas, consider use of environmental features as transitions between different land uses, in accordance with the recommendations of The Land Use Plan chapter.

- **Erosion and Sediment Control.** Encourage greater erosion and sediment control measures during development.

- **Stream and Shoreline Erosion.** Encourage greater protection, restoration and stabilization of streams and shorelines.

- **Steep Slopes.** Encourage preservation of slopes of 20 percent or greater adjacent to natural drainageways.

- **Education.** Consider enhancement and expansion of community, school and library outreach programs to educate the public of daily practices that protect and enhance water resources.

- **Preservation of Resources through Cooperative Efforts.** Encourage public and private cooperation in the preservation and use of environmental resources such as conservation and open space easements and park and recreational uses.

- **Preservation of Resources through Funding Efforts.** Seek funding opportunities for acquiring land and resources that benefit the public.

- **Retrofitting Existing Water Conveyance Systems.** Seek funding to correct environmental deficiencies by retrofitting and establishing stormwater quality facilities.

- **Energy Conservation.**

  - In accordance with The Land Use Plan chapter, promote mixed use developments which incorporate residential and non-residential uses, thereby promoting opportunities for various methods of transportation.

  - Encourage incorporation of energy efficiency in construction and rehabilitation that reduces costs for the owner or renter.

  - Promote developments that incorporate alternative energy sources such as geothermal, solar and wind.

- **Protect Drinking Water Sources.** Support water quality protection measures through the Chesapeake Bay Ordinance, Municipal Separate Storm Sewer System, Erosion and Sediment Control Ordinances and the Upper Swift Creek Watershed regulations.

- **Agricultural and Forestry Uses.** Provide for the preservation of agricultural and forestry uses by supporting conservation and open space easements, tax incentives and programs such as acquisition of development rights which promote rural preservation and support uses such as agri-tourism, farmer's markets, wineries, equestrian activities, community gardens and agricultural festivals.

- **Timber Harvesting to Accommodate New Development.** Consider provisions of adequate erosion and sediment controls for timbering activities related to new land development.

- **Mineral Resource Extractions and Landfills.** Consider the impacts of:
  - New mineral extractions and landfill proposals on existing and future land uses.
  - Existing and former mineral extractions and landfill operations on new development in the vicinity of the operations.
  - Consider proper and safe closure of sites to mitigate long term impacts.
  - Discourage residential development in proximity to mineral extractions and landfills.
  - Discourage new mineral extractions and landfills in proximity to existing and future residential development.
  - Consider methods to notify future property owners of sites previously used for mineral extractions and landfills of past activities and their potential impacts on future land uses.
  - Encourage the adaptive reuse of former mine sites and landfills for uses such as alternative and renewable energy sites.

- **River Corridors.** Promote preservation and enhancement of the scenic, historic, natural and open space qualities of the James and Appomattox Rivers.

- **Waterfront Access.** Support proposals for waterfront access while considering potential water quality impacts of water dependent uses such as docks, piers, boat ramps and marinas.